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$$\begin{aligned}
&= \frac{3\sqrt{3}a^2}{2} + \frac{\pi a^2}{21\sqrt{3}} \int_0^{4\pi} \left(\frac{\tan\theta}{\theta}\right)^2 d\theta \\
&= \frac{3\sqrt{3}a^2}{2} + \frac{\pi a^2}{21\sqrt{3}} \int_0^{4\pi} (1 + \frac{2}{3}\theta^2 + \frac{17}{45}\theta^4 + \frac{62}{315}\theta^6 + \dots) d\theta, \\
&= \frac{3\sqrt{3}a^2}{2} + \frac{\pi^2 a^2}{6\sqrt{3}} \left(1 + \frac{2\pi^2}{81} + \frac{17\pi^4}{18225} + \frac{62\pi^6}{1607445} + \dots\right) = 3.8693a^2 \text{ nearly.}
\end{aligned}$$

Also solved by the *PROPOSER*.

34. Proposed by B. F. FINKEL, A. M., Professor of Mathematics and Physics in Drury College, Springfield, Missouri.

Two points are taken at random on the circumference of a semicircle. Find the chance that their ordinates fall on either side of a point taken at random on the diameter.

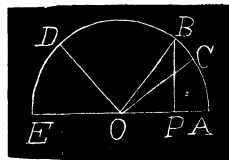
Solution by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas-Texas.

Let  $P$  be the random point on the diameter  $AE$ . Draw  $BP$  perpendicular to  $AE$ . Then one point must fall somewhere, as at  $C$ , on arc  $AB$ , the other somewhere, as at  $D$ , on arc  $BE$ . The chance thus obtained must be doubled as  $D$  might fall on  $AB$  and  $C$  on  $BE$ .

Let  $AO = \text{unity}$ ,  $\angle BOA = \theta$ ,  $\angle COA = \phi$ ,  $\angle DOA = \psi$ .

Then  $OP = \cos\theta$ .  $\therefore d(OP) = -\sin\theta d\theta$ .

Let  $p = \text{required chance}$ .



$$\begin{aligned}
\text{Then } p &= \frac{\int_0^\pi \int_0^\theta \int_0^\pi \sin\theta d\theta d\phi d\psi}{\int_0^\pi \int_0^\pi \int_0^\pi \sin\theta d\theta d\phi d\psi} = \frac{1}{\pi^2} \int_0^\pi \int_0^\theta \int_0^\pi \sin\theta d\theta d\phi d\psi \\
&= \frac{1}{\pi^2} \int_0^\pi (\pi\theta - \theta^2) \sin\theta d\theta = \frac{4}{\pi^2}.
\end{aligned}$$

## PROBLEMS.

42. Proposed by CHARLES E. MYERS, Canton, Ohio.

A attends church 4 Sundays out of 5; B, 5 Sundays out of 6; and C, 6 Sundays out of 7. What is the probability of an event that A and B will be at church and C will not?

43. Proposed by HENRY HEATON, M. Sc., Atlantic, Iowa.

In a circle whose radius is  $a$ , chords are drawn through a point distant  $b$  from the center. What is the average length of such chords, (1), if a chord is drawn from every point of the circumference, and (2), if they are drawn through the point at equal angular intervals?